Colorado Department of Public Health and Environment

FAQ

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Colorado Department of Public Health and Environment

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Rocky Flats Q&A

with Senator Jeanne Nicholson
Superior Town Hall – April 6, 2013
(recorded and forwarded by Debra Williams, Town of Superior Trustee)

1. **There is a lot of debate as to whether it is safe. If it is so safe as you contend, why not test it now as soil is being disturbed all around the refuge to ensure public health, after all that is what CDPHE is tasked to do?**

Additional sampling is not required because vast amounts of data regarding plutonium contamination at and near Rocky Flats have already been gathered. These data demonstrate that the area where plutonium contamination exceeds background levels is limited to a fairly small area immediately east of the former plant entrance on Indiana Street. Even the highest level of plutonium contamination recorded off-site poses a minimal risk – the odds of developing cancer as a result of exposure to this level of residual plutonium are about three in a million. In comparison, about 1 in 2 men will develop cancer during their life, as will about 1 in 3 women.

During characterization and remediation projects at the Site, about 1.3 million analyses were compiled from approximately 7,230 surface soil sample locations and from about 15,890 subsurface soil samples. These samples are reported in the RI/FS report (http://www.lm.doe.gov/Rocky_Flats/Regulations.aspx), which was compiled to support a Comprehensive Risk Assessment and the final remedy decision.

The average concentration of plutonium in the surface soil of the Refuge portion of the Site is 1.1 pCi/g (picocurie [trillionths of a curie] per gram): a concentration that equates to an excess cancer risk below one in a million for any exposure scenario. There is essentially no plutonium in the subsurface soils of the Refuge. Because of these very low concentrations, no remediation was required in the Refuge portion of the Site.

Substantial off-site sampling has also been conducted over many years by many different entities and these studies have shown generally consistent results. The most extensive off-site sampling was done as part of the CERCLA/RCRA investigation that covered a 38-square mile area to the north, east and south of Rocky Flats known as Operable Unit 3. During this investigation, 144 surface soil samples were collected from 61 different 10-acre sample plots. Only 19 of these plots showed plutonium concentrations above background levels; the rest were below background. Of the 19, only one had a plutonium concentration that exceeded 1 pCi/g (this sample result was 2.95 pCi/g). An additional 190 sub-surface samples were obtained

from 11 different trenches dug as part of the investigation. The subsurface investigation demonstrated that off-site plutonium contamination quickly declines with depth, and reaches background levels within about four inches of the surface.

The Operable Unit 3 study included the results from a 1991 sampling effort that collected 47 samples from soils directly east of the former east entrance to Rocky Flats. One of these samples recorded the highest level of plutonium ever observed in any off-site sample - 6.5 pCi/g. Under a residential use scenario (the most protective scenario), a plutonium concentration of 6.5 pCi/g equates to a risk of about 3×10^{-6} (that is, a three in a million chance of developing cancer as a result of a lifetime of exposure to contamination at this level). The cleanup goal at Superfund sites is to achieve a residual cancer risk somewhere between one in ten thousand and one in a million, so a three in a million risk is considered quite protective. The State's radiation dose limit for the public is 25 millirem per year (mrem/yr). The Total Effective Dose Equivalent to a resident from 6.5 pCi/g is 0.026 mrem/yr – well below the state's limit. The results for off-site areas are in a three-volume report of the investigation of Operable Unit 3 (Off-Site Areas). The first volume of the report can be accessed via the Administrative Record for Rocky Flats at:

http://www.lm.doe.gov/cercla/documents/rockyflats_docs/OU03/OU03-A-000465.pdf

Several other sampling efforts have produced similar results. For example, an independent Citizens' Environmental Sampling Committee performed a soil and sediment sampling study in 1996. The 78 samples collected ranged in concentration from background up to 4.5 pCi/g. The study concluded that these results "are consistent with the numerous other studies of off-site soils and sediments conducted by a variety of agencies over the years." You can find a link to this document on Colorado Dept. of Public Health & Environment's (CDPHE) web page at: http://www.cdphe.state.co.us/hm/rf/index.htm.

(See also the response to question #20)

2. **Medical studies are needed to determine if alpha-radiation emitters are detected in cancer tumors in the Denver metro area. Will you task your office to conduct these types of studies? If not, who will?**

We currently have ongoing cancer surveillance for the entire state of Colorado and we participate in a national surveillance program. If your request is understood, specifically you want more intense study of alpha-radiation emitters. If such a study could be done, it would be a very expensive, long-term study best handled by an academic center, such as the University of Colorado. CDPHE would certainly cooperate if asked to participate.

3. **There is a strong need for current epidemiological studies of the communities surrounding Rocky Flats. Will you conduct these kinds of research studies? If not, who will?**

Again, CDPHE has long-term epidemiologic surveillance of cancers, infections and other reportable conditions. That data and information is available on the CDPHE website. If more intense surveillance is desired by the community, the state legislators would need to request funding and direct the department. Central Cancer Registry: http://www.colorado.gov/cs/Satellite/CDPHE-PSD/CBON/1251618784014. Cancer Cluster Investigations: http://www.colorado.gov/cs/Satellite/CDPHE-DCEED/CBON/1251610480022.

Two of the several epidemiological studies that have already been conducted are cited in the response to Question #4 below.

4. **The medical community in the Denver area has cited frequent treatment of Rocky Flats-related diseases and medical issues. Has CDPHE considered creating a task force of medical professionals to track these frequencies among both construction workers and residents in the area?**

Chris Urbina: "I am not sure what medical community you are referring to regarding 'frequent treatment of Rocky Flats-related diseases and medical issues.' I would be open to discuss [these] concerns. Please contact us and please review the two studies regarding cancer exposure among the surrounding communities and workers:"

Report of Epidemiological Analyses Performed for Rocky Flats Production Workers Employed Between 1952 – 1989 (2003) and *Ratios of Cancer Incidence in Ten Areas Around Rocky Flats, Colorado Compared to the Remainder of Metropolitan Denver, 1980-89 with Update for Selected Areas, 1990-95 (1998)*. Both can be found at: http://www.colorado.gov/cs/Satellite/CDPHE-HM/CBON/1251615995394.

One conclusion of the first study is that Standardized Mortality Ratios for production era workers (1951-1989) were significantly lower for all causes of death and all deaths with cancer as an underlying cause. A key finding of the second study was that, "communities in the general vicinity of Rocky Flats had cancer incidence during 1980-89 that was comparable to the remainder of the Denver Metro area.

National Jewish Health also has an ongoing Rocky Flats worker surveillance program: http://www.nationaljewish.org/programs/prevention/former-us-department-of-energy-doe-worker-medical-screening-prog/.

5. **What will CDPHE do to prove to Colorado citizens that air quality will not be compromised? Are there air quality monitoring systems in place that measure particulate matter? Do we have a baseline for today so that if it is elevated the public can be properly alerted to protect themselves? Much like Red Advisory days?**

Air emissions from the Rocky Flats Site were evaluated in the final CERCLA cleanup decision. The "Air Contamination" section of the final cleanup decision document for the Site (CAD/ROD) states (pg. 29):

"*Air Contamination* - - Monitoring programs and other studies were conducted during both the production era and cleanup phase at Rocky Flats. These data show that contaminant emissions and resulting ambient airborne concentrations during both the weapons production era and cleanup phase were always compliant with all regulatory requirements. In fact, compliance monitoring at the facility fence line showed maximum airborne radionuclide concentrations of no more than three per cent of the limiting standard during the entire cleanup phase. With completion of all accelerated actions and the attendant removal of all historical air emissions sources except for wind erosion of the minor, remnant contamination in surface soils, future air emissions from the site will be less than those in the past."

The CAD/ROD acknowledges that re-suspension of residual radioactive contaminants attached to surface soil particles remains a potential source of ongoing air emissions. However, the most significant sources of radionuclide contamination were removed during cleanup (former processing and waste storage buildings were decommissioned, decontaminated, and demolished and contaminated soils were removed) and the Site is now much less susceptible to air emissions. The CAD/ROD states (p. 30):

"Air modeling conducted for radionuclide parameters predict that, even for scenarios involving a fire in the historic 903 Pad area, emissions will be much lower than the EPA's ten millirem benchmark level for an airborne exposure pathway."

Air monitoring essentially began when the Rocky Flats Plant began operating; large-scale, continuous air monitoring began as early as 1971. . DOE conducted effluent monitoring (stack and building emissions) and ambient air monitoring to demonstrate regulatory compliance, as well as to monitor fugitive radionuclide emissions from decommissioning, remediation, and demolition operations. At its peak, the radioactive ambient air monitoring included 39 samplers operating continuously both on-site and off-site. sets an annual dose standard of 10 millirem (mrem) effective dose equivalent (EDE) to any member of the public.

The air pathway was investigated as part of the comprehensive Remedial Investigation/ Feasibility Study: http://www.lm.doe.gov/Rocky_Flats/Regulations.aspx#RIFS. Section 6 of this report discusses the nature and extent of air contamination.

Wind tunnel experiments were conducted at seven off-site locations to measure the effects of wind erosion on different terrains. These investigations are described in a three-volume report of the investigation of Operable Unit 3 (Off-Site Areas). The first volume of the report can be accessed at: http://www.lm.doe.gov/cercla/documents/rockyflats_docs/OU03/OU03-A-000465.pdf. Wind tunnel studies were also conducted on-site following prescribed burn in 2002 to determine the effects of fire on air-borne contamination. Conclusions from this test burn were incorporated into the calculations for the Site's soil action levels.

The State also ran a couple of monitoring networks – one with stations inside the plant boundary and a network of 5 perimeter samplers. During closure, EPA set up monitors adjacent to cleanup projects to ensure that radiation limits for workers were not exceeded.

Now that potential sources in the surface soil have been removed, there is even less of a chance of radiological contaminants becoming airborne. Because of the history of analyses at or near the detection limit at the State monitoring stations, CDPHE's air sampling program ended in 2006. DOE discontinued its air sampling in 2007.

6. **At the meeting in Superior on Saturday, Carl Spreng spoke briefly about prairie dogs at Rocky Flats, saying we keep a close watch on them, that they die off from the plague but then come back. He said something like "we take care of them." I and others with whom I spoke thought he implied that the prairie dogs on the site are sometimes killed. Is it true that prairie dogs on the Rocky Flats site are sometimes killed? If so, who does it? And by what means?**

No prairie dogs have been killed at the Site. The prairie dog town that existed in the southeastern part of the Refuge when the Site closed was wiped out by plague and has not returned.

The US Fish & Wildlife Service's Comprehensive Conservation Plan for the Refuge calls for limiting prairie dog populations to "750 acres outside of recognized Preble's Habitat and Xeric Tallgrass Habitat." Populations will be controlled by trapping and relocating or "other methods." Local jurisdictions which manage open spaces around the Site also have prairie dog control programs.

The US Fish and Wildlife Service is currently engaged in a National Environmental Policy Act review for several "step-down" management plans for the Rocky Mountain Arsenal National Wildlife Refuge Complex, which includes the Rocky Flats National Wildlife Refuge. The step-down plans will be finalized and implemented in summer 2013 and include a Prairie Dog Management Plan (PDMP), which outlines methods to control black-tailed prairie dog populations. This plan provides a transparent decision-making process and information on the methods that will be used to control and maintain a healthy and balanced population of prairie dogs on the Refuge. *A public comment period runs from April 17 to May 16,* 2013.

7. **The land that has become the Rocky Flats National Wildlife Refuge was never part of any remediation during the cleanup of the Nuclear Facility. The Wildlife Refuge, particularly the eastern edge where the Parkway will be built, is known to be contaminated from several plutonium fires while the nuclear facility was operational, as shown in 1970 by Krey and Hardy of the Atomic Energy Commission and confirmed in 2011 by Marco Kaltofen of the Boston Chemical Data Corp. There also may be contamination excavated by burrowing animals as confirmed in Shawn Smallwood's 1996 study that identified 18 species of burrowing animals that dig 10-16 ft. below the surface, constantly taking surface material down, and bringing buried material up. In your opinion, should the refuge be developed upon and/or opened for public recreation, and if so, how should the public be informed of potential risks during any construction and visitation to the refuge?**

The Refuge portion of the Site is part of the former Buffer Zone of the Rocky Flats Plant, a security perimeter area added in the 1970s. Areas within the refuge were never used for processing, storage or disposal activities, and sampling confirms they are unaffected by site activities from a hazardous waste perspective; that is, no hazardous wastes or constituents have been placed in or migrated to the area that is now the Refuge. Because there is no buried contaminated material in the Refuge, there is no danger of contamination being brought to the surface by burrowing animals.

The existence of low levels of plutonium contamination in surface soil along the 300-foot right-of-way, primarily from wind-blown emissions from the 903 Pad, has been confirmed by several studies. These studies have consistently shown that plutonium contamination off-site is at very low levels, and soon drops off to background levels. At the public meeting, some confusion arose about the results of a study performed by CSU. There was concern that this study has shown plutonium concentrations along Indiana Street at 116 pCi/g. In fact, this study used a different measure of radioactivity, bequerels/m^2. 116 bequerels/m^2 is equivalent to about 0.3 pCi/g. These low levels of contamination pose minimal risks under any land use scenario.

The most comprehensive of contamination on or adjacent to Rocky Flats was the RI/FS report discussed in the response to Question #1. Of the thousands of samples analyzed for plutonium, the 31 samples collected within the 300-foot right-of-way for the Parkway average 1.4 pCi/g, which equates to a risk below one in a million for any exposure scenario. Of the 31 samples, eight are above the State's "construction standard" (see response to Question #20). These eight are clustered near the middle (north to south) of the right-of-way and average 3.2 pCi/g.

The samples that were used for the remedy decision for the Site were required to be collected, analyzed, and validated according to precise regulatory standards. Although the samples collected and analyzed by Kaltofen in 2011 did not meet these standards, the reported measurements (from 0.019 to 1.579 pCi/g) would confirm the very low levels of plutonium just off-site that have been measured by numerous other studies.

The final decision for the Refuge portion of the Site was based on an abundance of data and risk assessments demonstrating that risks to future refuge visitors and workers are extremely low. According to regulatory requirements and guidance, EPA and CDPHE agreed that the Refuge lands, including the right-of-way, could be available for "unrestricted uses and unlimited exposure."

Proposed language for signs at Refuge entrances has been drafted with the US Fish and Wildlife Service and reviewed in a public forum. The draft language does acknowledge potential low-level risks to visitors.

8. **I appreciate the measurement and contamination efforts, which have been made during cleanup phase. What level of cleanup has been performed on the specific area, which is proposed for toll road construction? Do we know the level of risk that exists of plutonium**

particles in the specific zone slated for construction? For instance, as a percent chance of exposure? Are the details and rationale for this level of confidence documented somewhere?

No cleanup was required on any of the land that became part of the Refuge. Data from the right-of-way strip was not specifically segregated for the final remedy decision, but it was addressed in the Environmental Assessment issued by the US Fish and Wildlife Service. The response to Question #7 provides details on sampling done within the right-of-way and the associated risk levels.

The Comprehensive Risk Assessment prepared to support the final remedy decision developed a site conceptual model which identified multiple exposure pathways. Risk to a construction worker was not directly calculated in that assessment. Because the exposure pathways, work activities and assumptions are similar to those used for a refuge worker, the risks should be somewhat similar. Differences include the potential for greater rates of inhalation and ingestion of soil by the construction worker. However, the longer exposures incurred by the refuge worker (18.7 years) predispose them to more adverse health effects than the construction workers (a few months) with their shorter exposure periods. In this case, levels protective of the refuge worker should also be protective for the construction worker. The conclusion is that the risks presented to a construction worker from the very low levels of residual plutonium in the right-of-way strip are at or below the applicable regulatory risk management criterion known as the CERCLA risk range. That range of risk values prescribes that cancer risks that exceed a probability of 1 in 10,000 are adverse and should be remediated; cancer risks below 1 in 1 million are considered to be negligible.

9. **Is Superior in the plutonium plume, especially from the fires of 1958 and 1969? If so, is it a fact that inhalation of even one particle of plutonium may result in cancer in humans?**

Reconstruction models of the 1957 fire show a distinct southeast direction of the plume from the Rocky Flats Plant based primarily on prevailing wind directions that day. The plume then bends towards northeastern Metro Denver. Superior and adjacent communities were not in the pathway of this plume.

During the 1969 fire, upslope conditions prevailed during the three hours when the highest releases occurred. The plume of contamination, therefore, was initially transported west of the Plant and the highest plutonium concentrations in air (0.67 pCi/m^3) were estimated at the west entrance.

Research has shown that a person would have to inhale large amounts of plutonium-contaminated dust particles to have a significant radiation exposure. One study concludes that, “Based on our calculations, millions of dust particles contaminated with PuO_2 [plutonium oxide] must be inhaled in order for significant radiation doses to be delivered to key body organs/tissues (bone surface, red marrow, lung, liver)”. (Scott, B.R., et al, 1999, *Recommendations for improving the interim radionuclide soil action levels for the Rocky Flats Cleanup Agreement*, Lovelace Respiratory Research Institute.) This conclusion is based on

several multiple-particle intake distributions generated for PuO_2 from re-suspended soil deposited in the respiratory tract. The mean intake of plutonium resulting from inhaling a certain number of contaminated dust particles from soils with a specific activity can be derived from these distributions. As an example, if someone breathed in a million dust particles from soil contaminated with plutonium at an activity level of 6.5 pCi/g (highest level measured off-site), the average intake is predicted to be only about 2.4×10^{-4} pCi (0.00024 pCi/g). These distributions demonstrate that although it may be possible for smaller numbers of plutonium particles to induce cancer in some individuals, it is highly unlikely. So in theory, a single exposure could initiate the chain of events which lead to cancer, but exposures that induce cancer risks below 1 in a million are considered to be negligible. (Also see response to Question #8.)

10. **Why were homebuyers required to sign a waiver that they were aware of the potential exposure to radiation by living close to Rocky Flats if it was deemed safe after the cleanup? And then, why did it become no longer necessary to alert homeowners living near it such as Candelas, Whisper Creek and other developments closer than Superior?**

Home owners were not required to sign waivers by the state or local governments. The Federal Housing Administration apparently began the waiver program in 1979 while the plant was still in operation. Input from current FHA personnel could not clarify why the program ended.

Off-site areas near Rocky Flats were thoroughly investigated and risk assessments confirmed that all areas adjacent to the Site could be used for any purpose. Samples collected on land being developed south of the Site present minimal risks and are at or below background levels.

11. **If we launch tons of dust at 6.5 picocuries/gram into the air, will it violate state standards? Should it be tested?**

State standards that are applicable to the assessment of dose to the public are the effluent limits in Table 4B2 in the Colorado Rules and Regulations Pertaining to Radiation Control (6 CCR 1007-1). The effluent limit for plutonium in that table is equivalent to 0.02 pCi/m^3.

Total Suspended Particulates (TSP) were measured at CDPHE's 5 perimeter air samplers from 1992 through 2002, including station X-3 located across Indiana Street from the Woman Creek Reservoir. Levels of TSP at X-3 usually averaged about 36 micrograms/cubic meter of air ($\mu g/m^3$) with the exception of the summer of 1995. During this period, particularly in August 1995, construction of the Woman Creek Diversion Reservoir was taking place immediately across the street from the X-3 site. As a result of earth moving operations, TSP levels at X-3 were very high with a maximum of 501 $\mu g/m^3$. Using this peak level as an average for a construction scenario, the maximum level of plutonium in the air due to 6.5 pCi/g in soil would be 0.00325 pCi/m^3:

$$501\ \mu g/m^3 \times 6.5\ pCi/g = 0.00325\ pCi/m^3$$

(This estimated value is an order of magnitude below the state standard for plutonium in air.)

The average concentration of plutonium particles sampled in the right-of-way is 1.4 pCi/g. (See response to Question #7.) This contamination is at the very surface and the vast majority of any dust stirred up by excavation activities would come from uncontaminated soil beneath the uppermost surface layer.

Excavation occurred on-site during the closure process in soil containing much higher levels of plutonium than exists in the transportation corridor. Air monitoring at the time measured only minor increases in contaminated dust in the air, and air quality standards were never even close to being exceeded. Much smaller amounts of airborne contamination would be expected from soils that contain much lower levels of contamination.

12. **What measures have you taken to protect the construction workers at adjacent developments given the fact that they work downwind from known radioactive contamination? What about those workers for the toll road?**

No measures are necessary. The concentration of plutonium in all off-site areas and on the Refuge is below levels that require any use restrictions. Measured concentrations in areas south of the Site where construction is currently occurring are well below 1 pCi/g and therefore do not trigger a requirement for "special construction techniques." (See response to Question #20.) However, levels along part of the right-of-way do exceed the 1 pCi/g standard, so "special construction techniques" may be required there.

13. **What USE has the CDPHE made of the cancer registry to determine plutonium-related cancers? How are these radioactive materials being studied and tracked involving cancers?**

CDPHE has widely circulated the results of these studies, published the findings and had numerous community meetings. It has ongoing surveillance of all cancers in Colorado. (See the Central Cancer Registry referenced in the response to Question #3 above.)

14. **The most harmful ways to be exposed to plutonium and other toxic contaminants of nuclear facilities, such as tritium and beryllium, are through inhalation. Referring to Standley Lake, the DOE document "Historical information Summary and Preliminary Health Risk Assessment Operable Unit 3 Sites 200, 201, 202" states, "[the] sediment in the reservoir is effectively holding the plutonium and preventing its movement into municipal drinking water," yet Standley Lake turns over twice a year, disturbing an unknown amount of sediment. What is currently being done to monitor contamination dispersal during spring and fall turnover of sediment in Standley Lake, since it is used as a water supply for Westminster, Thornton and Northglenn? Should this occur? How does this protect the health of citizens?**

EPA first studied Standley Lake in the early 1970s. Several other later studies indicated that the sediments in the reservoir contained levels of plutonium slightly above global fallout levels,

probably attributable to 903 Pad releases. Water sampling by the City of Westminster and DOE established the immobility of plutonium in Standley Lake sediments. Extensive sampling in Great Western Reservoir by the City of Broomfield and DOE also confirmed the immobility of plutonium in the sediments there. Studies of Standley Lake fish conducted by CDPHE in 1989 found no radionuclides in tissue samples. The amount and depth of plutonium contamination in the reservoirs was reaffirmed by sediment sampling and coring done for Operable Unit 3 (Off-Site Areas) at 99 locations. Nearly 200 sediment samples were collected and analyzed for plutonium in Great Western Reservoir and Standley Lake; the average plutonium concentrations were 0.267 pCi/g and 0.033 pCi/g respectively. (See sections: 2.3.3, 4.5, and 7.1.3 of the OU 3 RFI/RI Report at http://www.lm.doe.gov/cercla/documents/rockyflats_docs/OU03/OU03-A-000465.pdf)

The ultimate and most important testing of the water in Standley Lake is done by the cities that use it as a drinking water supply.

15. **Can we seek to reduce the state standard of plutonium contamination of 2.0 disintegrations per minute per gram of soil? This is not the original figure and it was raised to accommodate higher contamination as society experiments with nuclear testing.**

This construction guideline is well below cleanup levels established at any remediation site in the country. There was considerable uncertainty about the calculations used to derive it in 1973 when it was adopted and there was debate about whether to raise or lower the number. Using currently accepted input parameters, this value equates to a risk that is below EPA's acceptable risk range for any exposure scenario.

Anyone can approach the Board of Health with proposed changes to regulations. Check with the Board to determine what specific procedures would apply.

16. **What micron size filters were and are being used in suspended particulate air monitoring?**

Air monitoring done by the State at Rocky Flats met all applicable state and federal requirements pertaining to sampling equipment used, particle size collected, and analyses performed. The Air Pollution Control Division of the Department of Public Health & Environment collected samples for radiological analysis of both TSP (total suspended particulates) and PM10 (particulates 10 microns in diameter and smaller). Particulate filters used have a flow rate of 1 m^3/minute: a.) 8"x10" fiberglass for TSP and b.) quartz-fiber for PM10 (using a size-selective inlet).

"Inhalable" particles are defined by EPA as the fraction of airborne particulates that are 10 microns and smaller. Monitoring for PM10 is conducted at many air monitoring sites throughout the state. PM2.5 monitoring commenced in 1997 and is also performed at a number of sites.

17. **Do you monitor surrounding areas, not just "on-site?**

Routine air, ground water and surface water monitoring began at the time the Site was established; air monitoring ended in 2007. In addition to the site contractors, the Colorado Department of Public Health and Environment began monitoring air, water and soil around Rocky Flats on a regular basis in July 1970. The Public Health Service, and later the Environmental Protection Agency, monitored the air and water in the vicinity of Rocky Flats beginning in April 1960. Monitoring was also carried out by the cities of Westminster and Broomfield. Other environmental media were sampled because they were considered potential exposure pathways or to characterize them for cleanup.

a.) Soil – About 1.3 million soil analyses determined the extent of soil contamination and based on these data, contaminated soil was removed from the site. Confirmation samples assured state and federal regulators that residual contamination on-site and off-site are below regulatory limits and therefore, soil sampling is no longer conducted.
b.) Sediments – Sampling in on-site ponds determined the extent of sediment removal. Very low levels of plutonium in Great Western Reservoir and Standley Lake sediments did not require removal. Surface water leaving the site is continuously monitored and is now routed around these reservoirs.
c.) Vegetation – Vegetation data from routine monitoring and special studies provided information on how radioactivity was spread out around Rocky Flats.
d.) Wildlife – Several studies examined animal tissues to understand if any animal species were being contaminated. A U.S. Fish & Wildlife Service study concluded that the small amount of radionuclides in tissues from deer at Rocky Flats was similar to the amount in tissues from deer taken elsewhere in Colorado.
e.) Ground Water – Hundreds of wells defined the concentrations and extent of contamination in ground water (solvents and uranium) and four treatment systems are currently treating the affected plumes. About 100 wells are currently being monitored on-site.
f.) Surface Water – At this time, this water is monitored before it leaves the central area controlled by DOE and at several upstream locations.
g.) Air – After decades of collecting air samples both on-site and off-site, air monitoring has been discontinued by all three agencies. Even while dust was being stirred up during cleanup of the most contaminated areas on-site, the amounts measured at the sampling stations were well below national and state standards. (See the responses to Questions #5 and #11.)

18. **What are existing H2O test results in Superior's water supply?**

Superior's Drinking Water Consumer Confidence Report for 2012 states, **"**All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk." The Town's drinking sources are Carter Lake and Terminal Reservoir via Marshall Lake. The water is tested for microbial, inorganic, herbicide, pesticide, radioactive, and organic

chemical contaminants. The Maximum Contaminant Level for alpha radiation (the type of radiation that plutonium emits) is listed as 15 pCi/L, which is the same as for drinking water supplies in other municipalities. The average level measured in 2012 was 1.4 pCi/L and "erosion of natural deposits" was given as the "typical source." This amount of plutonium would, however, be considered an exceedance of the plutonium standard for surface water leaving the Rocky Flats Site, where a 0.15 pCi/L standard is imposed by the state.

19. **How long did the analysis and monitoring continue? What has been discontinued regarding monitoring?**

See the response to Question #17.

20. **Is it too late to block the road to nowhere? Dig now, ask questions later, and test later?**

CDPHE does not have a position regarding the desirability of the proposed Parkway. It does, however, have a position regarding the protectiveness of the remedy in the area of the right-of-way transferred from the Refuge property. Those questions have already been asked and answered: the testing has already been done and the results are available. (See response to Question #7.) The analysis of all the sampling done in the lands that became the Refuge support a decision that allowed EPA and the CDPHE to declare that the Refuge lands are suitable for any use.

There are a number of state and federal environmental requirements that may apply to the proposed construction, such as a stormwater permit, dredge and fill permit, air permit, etc. The decommissioning criteria in Section 4.61 of the Colorado Standards for Protection Against Radiation (6 CCR 1007-1) set dose limits for members of the public. These limits were considered "relevant and appropriate requirements" for determining if the Refuge lands were acceptable for unrestricted use. Surface soil sample results in the Refuge indicate that doses to members of the public would be less than 1 mrem/year, far below the state's residual radiological criteria for unrestricted use, which is 25mrem/year. Section 4.60 provides a level of activity from plutonium that triggers a requirement to use "special techniques of construction" in "uncontrolled areas." This level of 2 disintegrations per minute per gram of soil (approximately 1 pCi/g) was set back in 1973 and was designed to keep radiation exposure as low as reasonably achievable. These requirements have been determined to not apply to refuge lands because the land is under federal jurisdiction and therefore is not "uncontrolled." The requirements do apply however, to land that is transferred out of federal jurisdiction.

In cases where §§ 4.60 and 4.61 apply, the Colorado Department of Public Health and Environment would evaluate appropriate construction controls, which would likely consist of dust suppression. Any controls would be applied to achieve the intent of the requirement to lower any exposure to levels as low as reasonably possible.

(Also see response to Question #17.)

21. **Pamela Puhl-Quinn from the Daily Camera: The CDPHE has acknowledged that a construction worker working on the parkway will be exposed to more plutonium-laden dust than a refuge worker. In addition, there are independent studies, which show plutonium in soil along the eastern corridor of levels higher than background, i.e. at levels consistent with 1970 measurements (Kaltofen Boston Chemical Co 2011 Study). So studies agree that the soil on the eastern corridor is contaminated with plutonium at levels higher than background.**

a.) What preconstruction studies will the CDPHE undertake related to the contamination level of the soil?
b.) Will any further soil monitoring in these areas be done BEFORE digging occurs?
c.) What monitoring will the CDPHE do during construction? Any specific air monitors?
d.) Will results of monitoring be made public?

The contaminant levels in the right-of-way strip are well-established by existing samples. (See response to Question #7.) We have not yet determined whether any more samples are needed to make decisions regarding the application of our requirements in Section 4.60 of the Colorado Standards for Protection Against Radiation. (See responses to Question #8 and Question #20.) If air monitoring is conducted, either by the state or voluntarily provided to the state, the results will be accessible to the public.

22. **Surface cleanup to 3-6 ft., trenches, buildings, walls, etc. have been identified as buried. Question for Legacy Management, for residual contamination: There are two remaining ash pits with unknown potential risks? What has become of those?**

The Rocky Flats Legacy Management Agreement (http://www.lm.doe.gov/Rocky_Flats/Regulations.aspx) Figure 3 of Attachment 2 shows remaining infrastructure in the DOE-retained portion of the Site. The infrastructure consists mostly of decontaminated building slabs and tunnels. Process waste lines that were not removed were flushed then grouted in place. Figure 4 shows where pits and trenches, including the Ash Pits, were left in place.

These features are noted and located in this three-agency Agreement so that even though they do not pose an exposure risk, their presence will be considered by any future maintenance activities. Controls prohibiting digging and drilling are in the Agreement, in the final decision document, and in an Environmental Covenant with the State. The area of the ash pits is inspected annually for any signs of disturbance or erosion. Monitoring stations in the Woman Creek drainage analyze collected water for uranium and would report any impacts to surface water. The ash pits have been there for around 50 years and surface water remains un-impacted.

23. **Colorado's standard for plutonium in soil and its relation to respirable dust. A statement prepared by LeRoy Moore, PhD, April 6, 2013:**

In response to revelations of major releases of plutonium from Rocky Flats, in January 1973, Colorado mandated that land where plutonium contamination exceeds 0.2 disintegrations per minute per gram of soil (dpm/g) is "unfit for residential use, subdivision development, or commercial and industrial uses." (*i*) Less than two months later, the state increased by tenfold the amount of plutonium to which exposure was allowed, from 0.2 to 2.0 dpm/g while at the same time dropping its prohibition against residential, commercial, or industrial uses in areas too contaminated to meet the new, more relaxed standard. Hereafter, it would merely require "special techniques" for construction in such areas, such as plowing plutonium under. (*ii*) Thus, the state gutted its original, fairly-protective standard for one that is essentially worthless.

Speaking at an EPA hearing in Denver in 1975, NCAR radiochemist Edward Martell pointed out that 2.0 dpm/g equals 0.9 pCi/g, or about 1.0 pCi/g. Allowing 1.0 pCi/g of plutonium in surface soil "will give rise to an estimated 10 to 100 pCi/g of insoluble airborne dust of respirable size." It thus is far from clear he said, that the state standard "is safe and acceptable." It may be "at least 20 times too high." (*iii*)

The state of course has never taken seriously its responsibility to test respirable dust on or off the Rocky Flats site for its plutonium content. My question is this: At this point, in the event that construction of the Jefferson Parkway begins as planned along the most contaminated edge of the Rocky Flats site, can we expect CDPHE to test airborne respirable dust in and around the construction area for its plutonium content? If so, what equipment will be used and how will independent monitoring be accomplished. If not, why not?

(*i*) Cleere, R.L. 24 January 1973. Public notice of plutonium contamination in the area of the Dow Chemical Rocky Flats Plant, signed R. L. Cleere, Executive Director, CDH.

(*ii*) Amendment to the State of Colorado Rules and Regulations Pertaining to Radiation Control, Subpart RH 4.21.1, adopted Colorado State Board of Health, 21 March 1973.

(*iii*) Martell, E. A. January 1975. Basic considerations in the assessment of the cancer risks and standards for internal alpha emitters. Statement presented at the public hearings on plutonium standards, US EPA, Denver, pp. 17, 20.

The time since 1973 has added considerable amounts of data, context, and consensus guidance to the discussion about protective levels of radiation exposure. Contrary to the inquiry, a 0.9 pCi/g concentration has proven to be extremely protective – much more conservative than cleanup levels used anywhere else in the nation. This level corresponds to an annual dose of less than 1 mrem – a fraction of the state's (and the Nuclear Regulatory Commission's) 25 mrem/year residual radiological criterion for unrestricted use. It can also be compared to the approximately 600-mrem dose that Coloradans get each year from natural and other sources such as medical x-rays.

24. **At the meeting on Saturday, Dr. Chris Urbina of CDPHE stated that the main reason the cost of doing the cleanup at Rocky Flats was reduced from DOE's original estimate of $36**

billion to $7 billion was due primarily to reducing the time spent on the cleanup from 70 years to 10 years.

In December 2001, Kaiser-Hill provided to the Rocky Flats Cleanup Agreement Focus Group a pie-chart that showed all costs associated with its contract to complete the cleanup and close the site in 10 years for about $7 billion. On its chart, 93% of the $7 billion was allocated to cover the cost of site security, relocation of special nuclear material (plutonium and enriched uranium), removal of bomb-production waste, and demolition of buildings. Only $473 million, about 7% of the total, was allocated for actual remediation of soil and water on the site – that is, environmental cleanup.

Two of the more expensive items on the K-H list – relocation of special nuclear materials and removal of bomb-production waste – would be expedited regardless of how many years were to be devoted to cleanup. And removing these two items from the list would greatly reduce security costs. These three items would not have to be paid for 70 years. And there's no reason to think that demolition of the more contaminated buildings would be long delayed once materials requiring high security have been removed from them.

DOE's 1996 Baseline Environmental Management Report, the first report to show reductions from its original $70 billion estimate for the Rocky Flats cleanup, projects large cost reductions in handling nuclear waste, environmental restoration, and decontamination of buildings prior to their demolition. Some cost reduction is also attributed to the decision to do a "risk-based" cleanup, by which I believe DOE means the cheaper cleanup only to the level required to protect a wildlife refuge worker. Since Dr. Urbina's statement differed so greatly from the information I have provided here, I'd like to ask him for the source and documentation of what he as head of CDPHE said. I certainly would like to know if I have been misinformed.

Reducing mortgage costs, roughly $475 million per year at the start of cleanup activities at Rocky Flats, meant the amount of funds for actual cleanup work could increase. Over 30 years, the $475 million per year comes to roughly $33 billion and that amount would not have included cleanup work. So by reducing the security costs, shipping special nuclear material off-site, and cleaning up and taking down buildings, substantial amounts could be saved from the original projections. The faster work could get done, the greater the savings. Very tight and efficient project management, along with the congressional promise of a steady budget, allowed this to happen.

The dose-based action level for plutonium contained in the cleanup agreement in 1996, 651 pCi/g, is the level used as the basis for the cleanup costs that were originally estimated at $70 billion. When the action levels were reset, the calculated risk-based action level, 116 pCi/g, was reduced to 50 pCi/g after discussions with surrounding communities. Using this level to trigger remedial actions resulted in an average residual concentration of 2.3 pCi/g of plutonium in soil in the DOE-retained area of the Site. The reduction in overall cleanup costs did not result in a lesser cleanup – it left the Site in a more protective state.